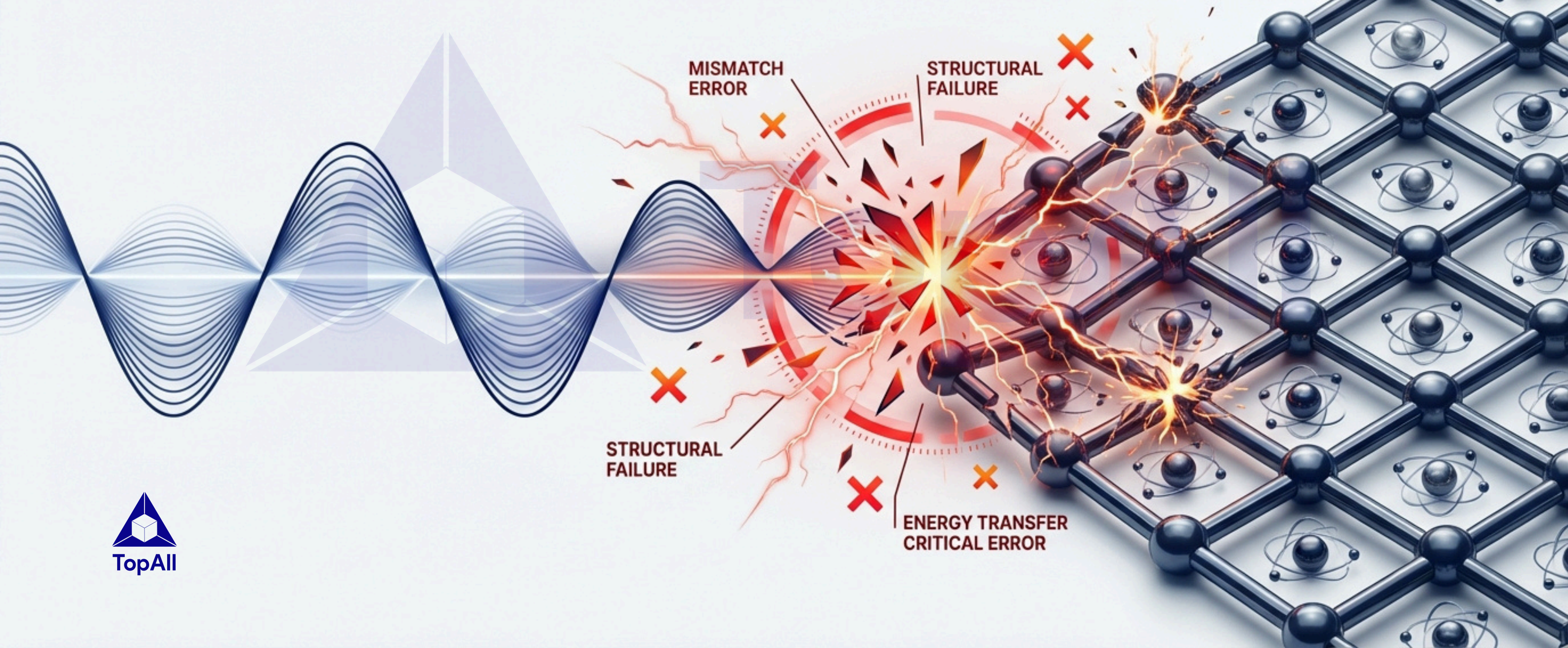


Why Wave Theory Failed

The crisis in classical physics



What Wave Theory Predicted

The logical, but ultimately flawed, expectations of classical physics.



Continuous Absorption

Energy is distributed continuously over the entire advancing wavefront.



Brighter = Faster

Higher intensity means greater amplitude. This should increase the maximum kinetic energy (K_{max}) of emitted electrons.



No Threshold

No minimum frequency should exist. Any color of light, if intense enough or shone long enough, will eject electrons.

What Experiments Actually Showed

The empirical data that completely shattered the classical wave model.



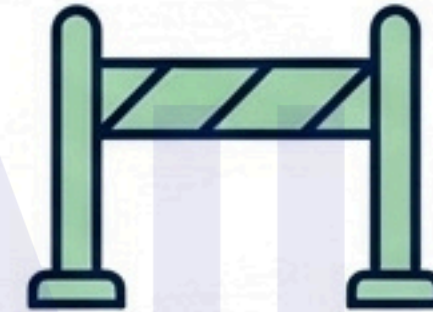
Instantaneous Emission

Electrons are ejected immediately upon illumination, completely contradicting continuous absorption.



$K_{\max}$ is Independent

Maximum kinetic energy depends only on the light's frequency, remaining totally unaffected by intensity.



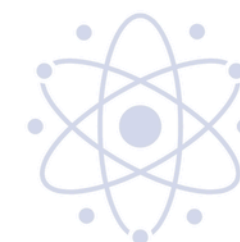
Threshold Exists

A strict minimum threshold frequency (ν_0) must be met, or zero emission occurs—regardless of intensity.



You've Learned the Theory. Let's Test Them Now.

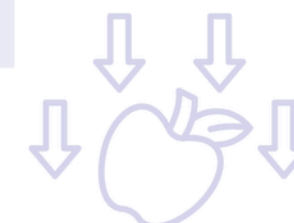
$$E=mc^2$$



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The Big Contradiction

Parameter	Wave Theory Prediction	Experimental Reality
Kinetic Energy Dependence	Increases with light intensity.	Depends only on frequency; independent of intensity.
Time of Emission	Significant delay (continuous energy buildup).	Instantaneous process.
Frequency Requirement	No minimum frequency needed.	Strict threshold frequency (ν_0) is required.

The Time-Lag Problem

Wave energy is spread too thin to eject an electron quickly.



Wave Theory: Hours

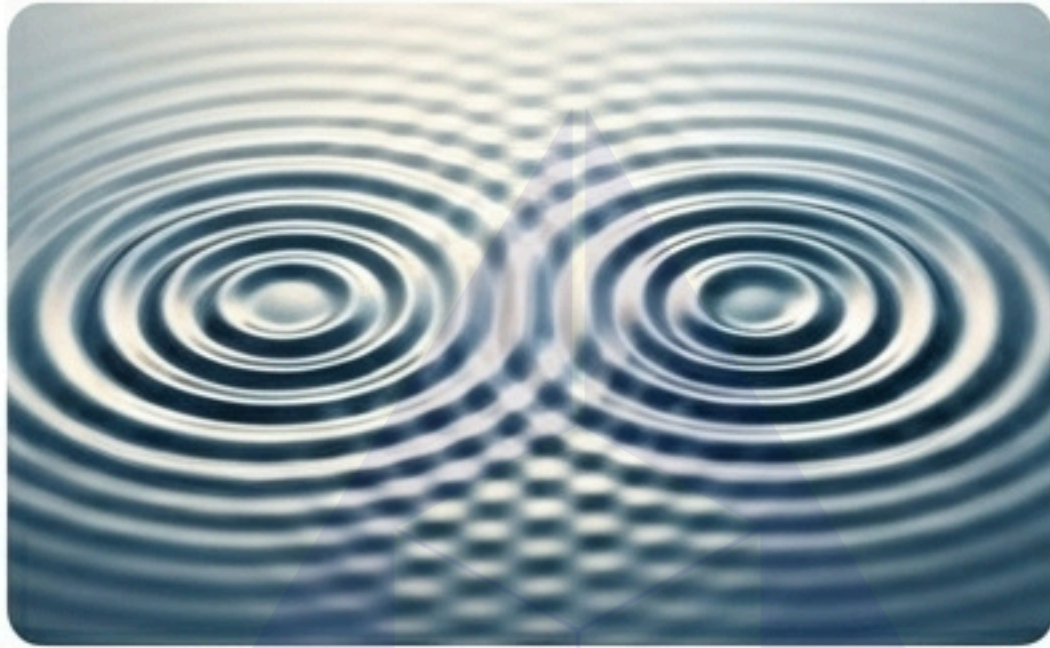
Because energy is spread continuously across a wide wavefront, a single electron would need hours to absorb enough energy to overcome the work function (Φ_0).



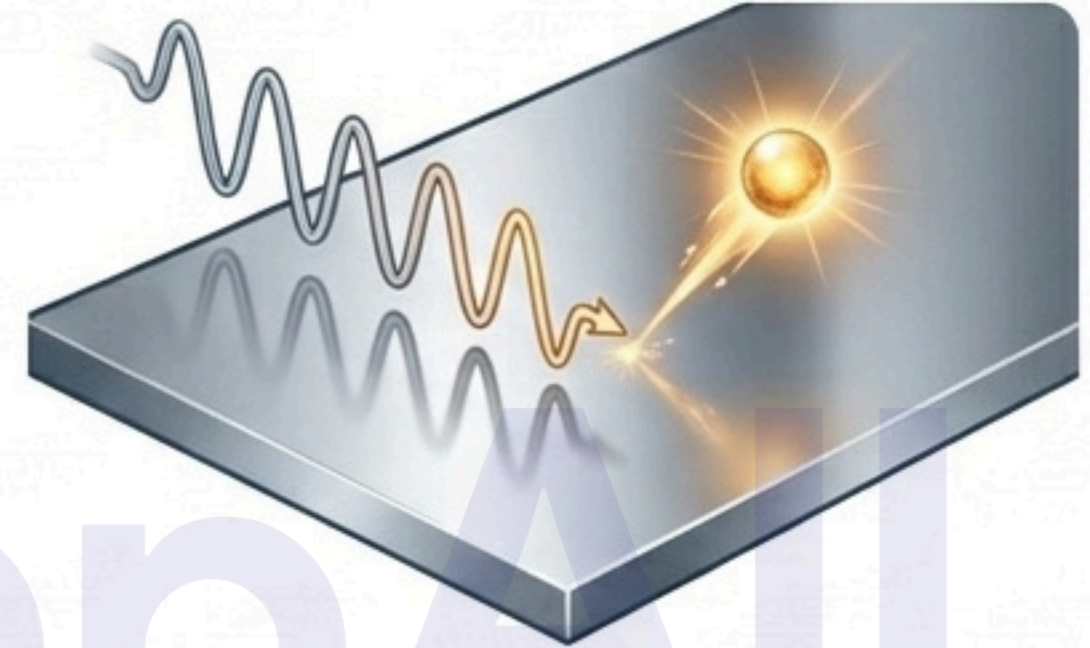
Reality: $< 10^{-9}$ Seconds

Emission starts instantly, even when the incident radiation is made exceedingly dim. No continuous buildup occurs.

Key Takeaways



Classical wave picture perfectly explains macroscopic propagation: Interference, Diffraction, and Polarization.



Fails entirely for matter-light interaction: Cannot explain the Photoelectric Effect's thresholds or instant emission.

The Conclusion: A radically new model of light—quantized into discrete packets of energy—became absolutely necessary.



You've Learned the Theory.

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